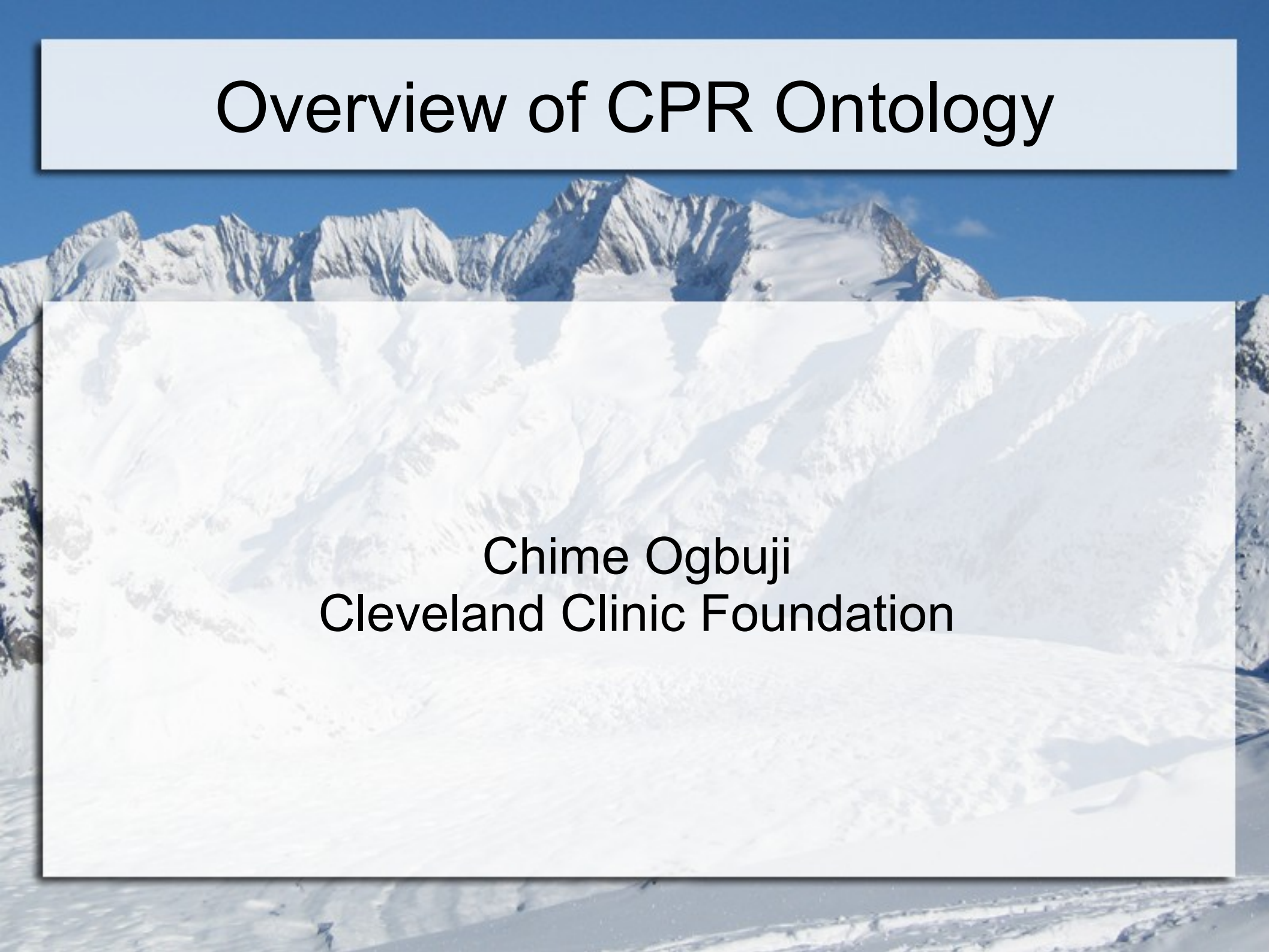


Overview of CPR Ontology



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What is a CPR?

Computer-based Patient Record (CPR): An electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids.

- Institute of Medicine (IOM) 1997

Defines medical records systems of the future and the important features that distinguish them for **EHRs** of 1997



What is the CPR Ontology?

- Addresses terminology requirements of a CPR
- IOM defines a set of requirements for CPR systems regarding *record content*
 - **Uniform, core data elements**
 - Standardized coding systems and formats
 - A common data dictionary
 - Information on outcomes of care and functional status

What is the CPR Ontology?

- Defines a *minimal* set of terms
- Provide principled, ontological commitment for the terms used in many of the healthcare information terminology systems
- Relies on the use of foundational ontologies and ontology engineering best practices.
- An upper ontology of clinical medicine
 - Similar motivation as OGMS

CPR Ontology goals

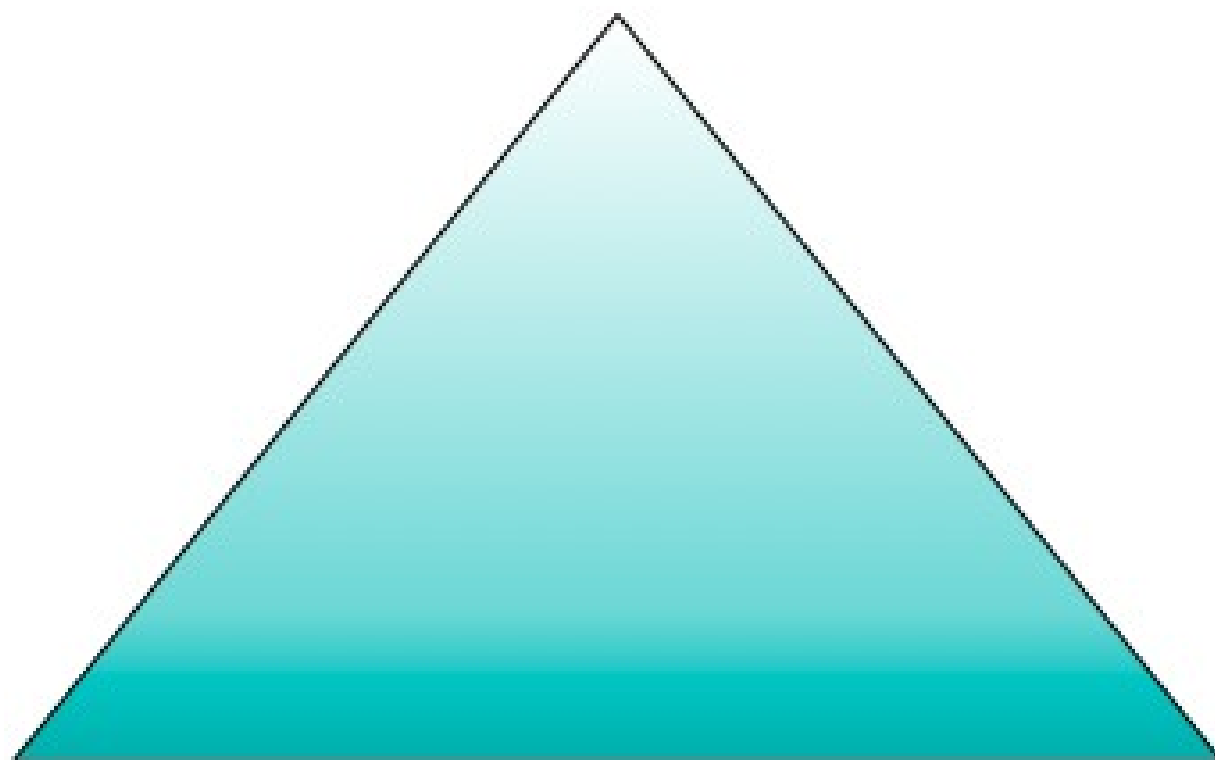
- In order to achieve *uniformity*, it needs to have significant coverage
 - Pyramid ontology paradigm: small, well-organized top; wide, idiosyncratic bottom.
- Adopt cogent conceptual models that appeal to an ontological study of clinical medicine

Reinventing the Wheel?

- Why not re-use GALEN?
 - Dated and deprecated
- Why not re-use SNOMED-CT?
 - Licensing issues and lack of ontological grounding (it lies in towards the bottom of the pyramid)
 - Issues with inconsistent and incomplete definitions

Framework

- BFO
 - Domain-independent upper ontology
- BioTop
 - Integrating foundation for both clinical medicine and the life sciences
- CPR
 - Clinical medicine: study of medicine based on direct observation of **patients**



BFO

BioTop

CPR

SNOMED-CT, FMA, CCR, etc.


















































Role of BioTop

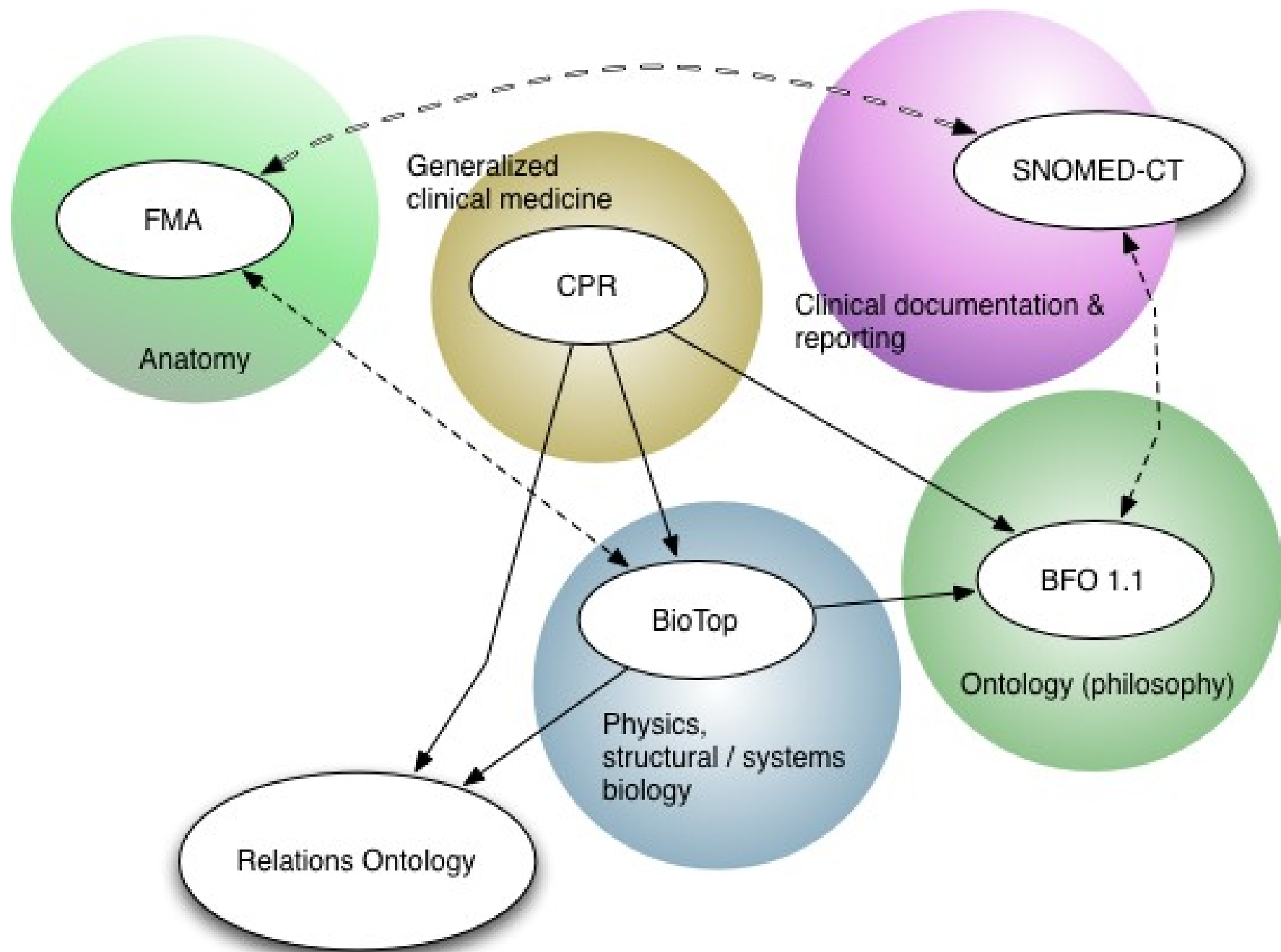
- A “*mediating layer for the life sciences domain*”
- Proposed as a candidate upper ontology for SNOMED-CT (covers health care as well)
- Coverage of biology and biomedicine at various levels of granularity
- Bridge between formal, upper ontologies and domain-specific ontologies

BioTop Coverage

- Supports integration of:
 - Gene Ontology
 - Cell Ontology
 - Chemical Entities of Biological Interest

BioTop's Range of Granularity

- ▼  snap:IndependentContinuant
 - ▶  biotop:ImmaterialNonphysicalEntity
 - ▶  biotop:ImmaterialPhysicalEntity
 - ▼   biotop:MaterialEntity
 - ▶   biotop:CollectiveMaterialEntity
 - ▶   biotop:CompoundOfCollectiveMaterialEntities
 - ▼  biotop:MaterialEntityBySizePartition
 -  biotop:Atom
 - ▼   biotop:MonoMolecularEntity
 -   biotop:Biomolecule
 -   biotop:EntireMolecularEntity
 - ▶   biotop:MolecularEntityByGranularityPartition
 - ▼   biotop:MolecularEntityByOrganicInorganic
 - ▶   biotop:InorganicMolecularEntity
 - ▼   biotop:OrganicMolecularEntity
 -   biotop:BioMolecularSequenceStructure
 - ▼   biotop:OrganicMolecularEntityPartition
 - ▶   biotop:AminoAcidOrPeptide
 - ▶   biotop:Carbohydrate
 -   biotop:FattyAcid
 -   biotop:HeterocyclicBase
 - ▶   biotop:Lipid
 - ▼   biotop:NucleicAcidNucleotideOrNucleoside
 - ▼   biotop:NucleicAcid
 - ▼   biotop:ChainOfNucleotideMonomers
 -   biotop:DNA
 -   biotop:RNA



Method(s) behind the Madness

- Realist ontologies (BFO-based)
- Situations, findings, & observables (Rector 2008)
- Surgical procedures (GALEN)
- Representational artifacts v.s. their referents (Vizeno 2007)
- Problems and screenings (Weed 1968)

Method(s) behind the Madness

- Care act hierarchy and clinical workflow (Bayegan 2002)
- Disease, diagnosis, etiology and the Disease Entity Model (Whitbeck 1977)
- Disease, diagnosis, bodily features, etc. (Scheuermann et al. 2009)
- Integrating anatomy, physiology, and pathology (Rosse et al. 2005)

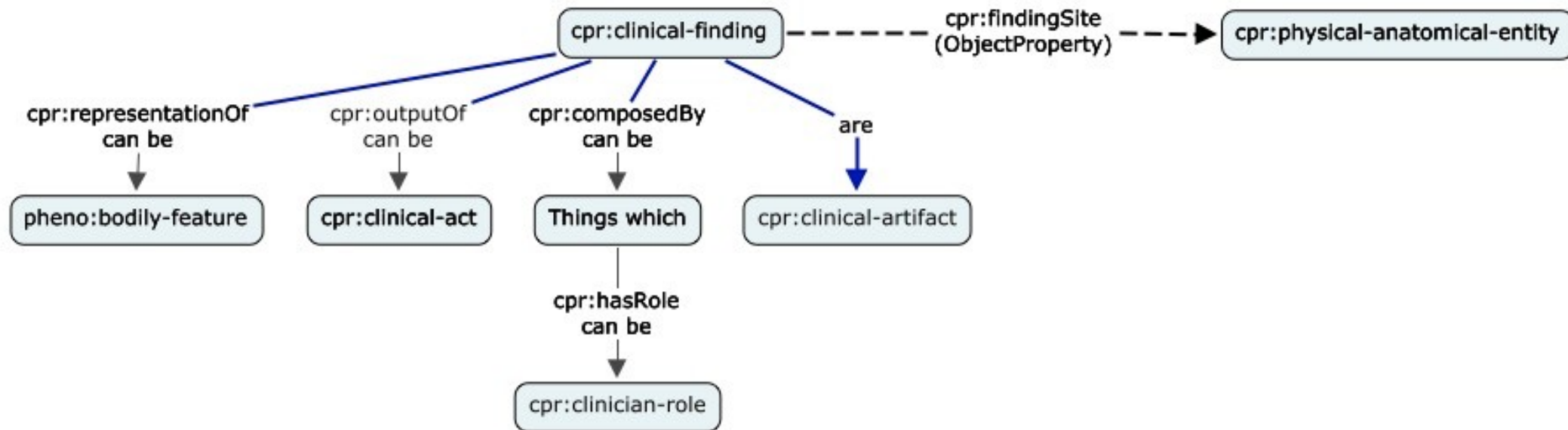
General Rules of Thumb

- Use realist ontology approach to the extent that distinctions are useful for real-world clinical informatics problems
 - Avoid reductionism trap
- Validate against data and standard, controlled-vocabularies
 - Patient data and SNOMED-CT primarily

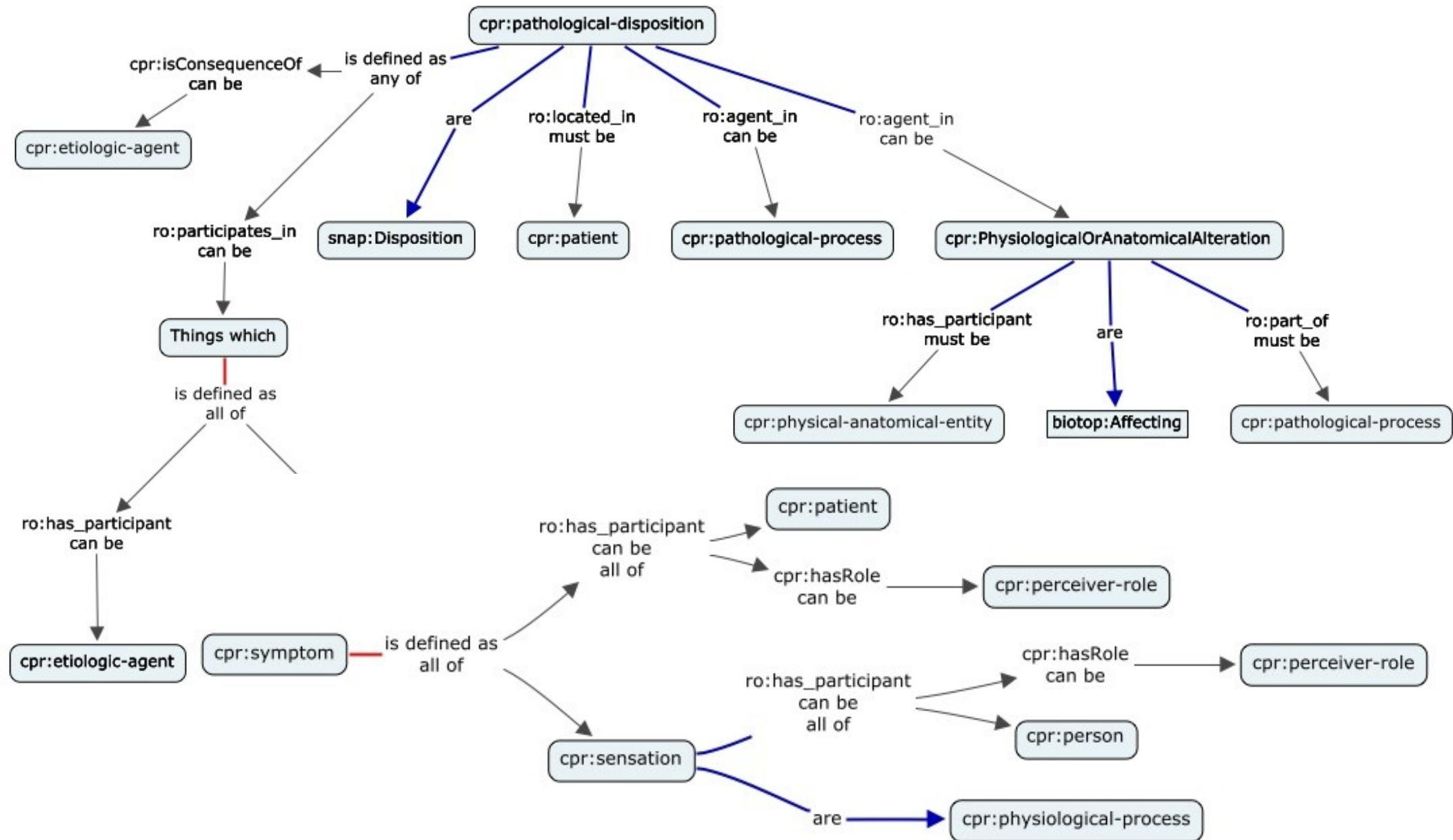
Patient Care Activity Hierarchy



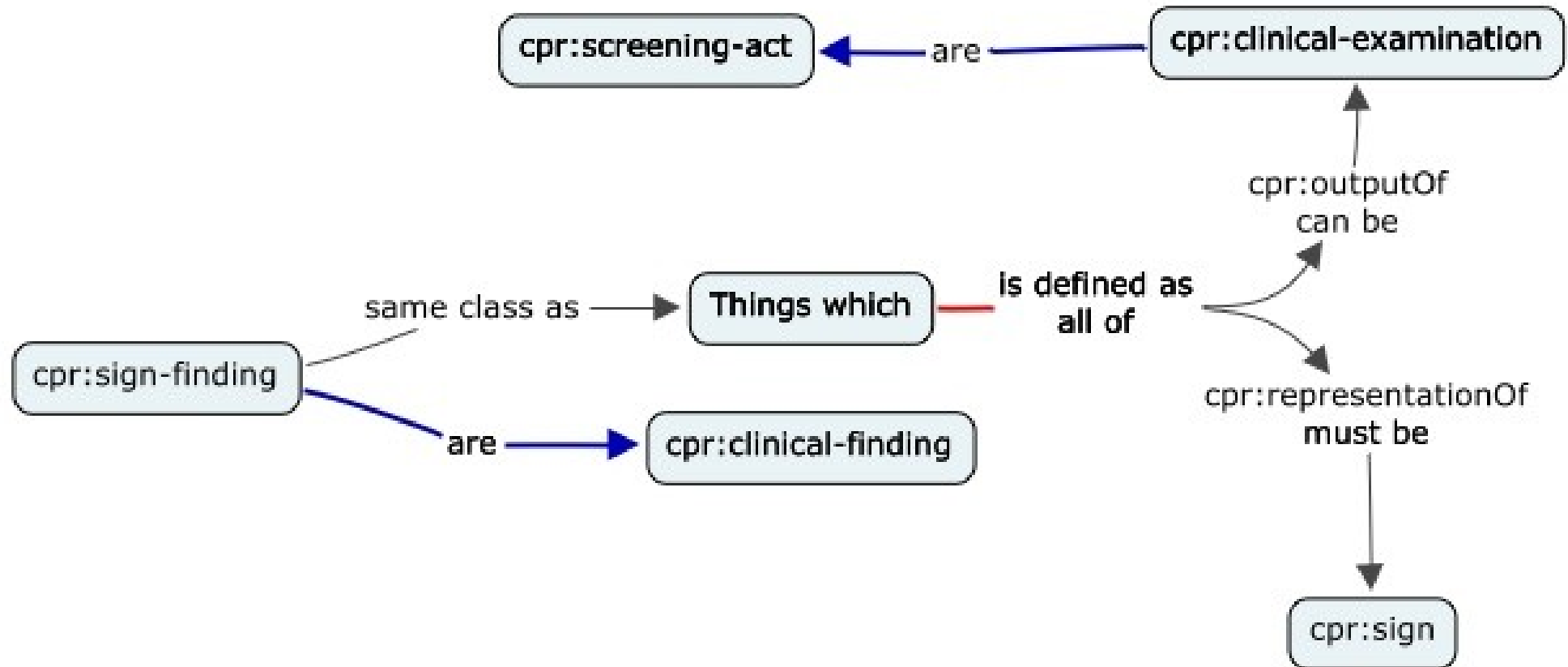
Clinical Findings



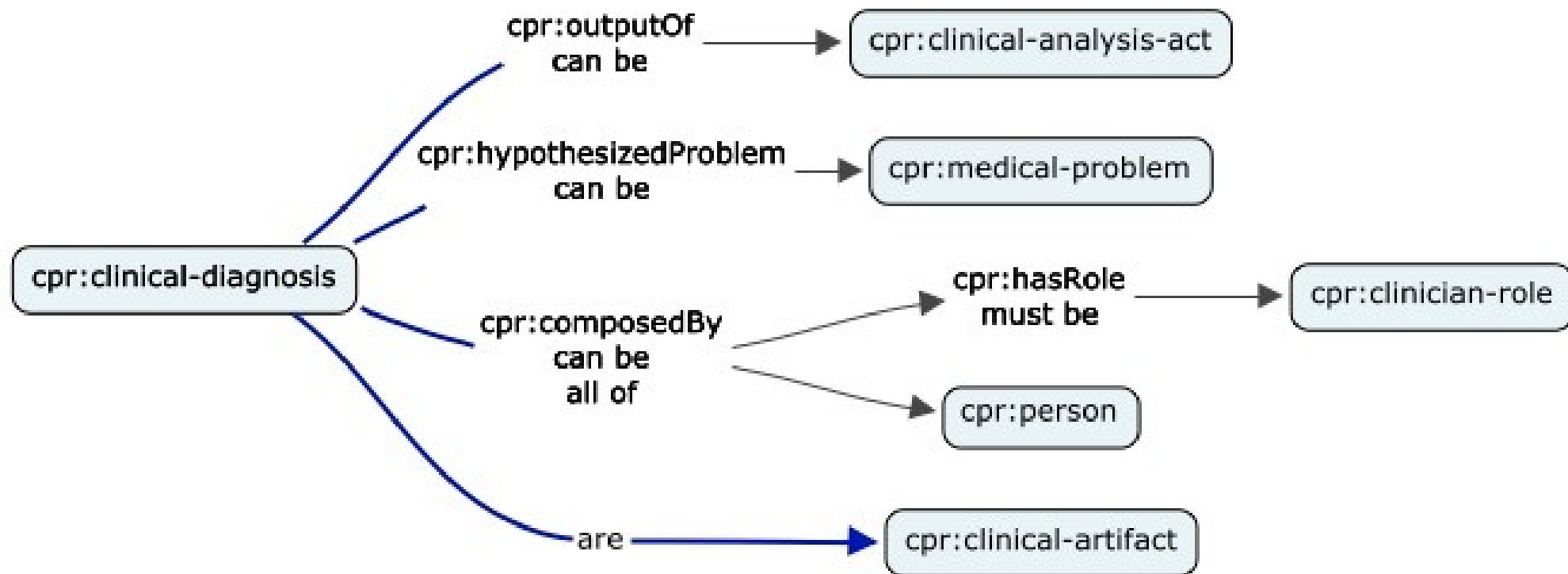
Diseases and Their Manifestations



Signs and Their Recordings



Clinical Investigations and Diagnoses



Validating CPR

- Validated against local controlled vocabulary
 - Terms used in large, RDF-based HVI patient registry (200,000+ patients) for outcomes research
 - 4051 OWL classes
 - Systematically attempted to find a principled location for each class

Validating CPR

- Validated against SNOMED-CT and FMA extracts
 - Recent research on aligning both ontologies and extracting segments from them
 - Developed software to perform extraction and place segments within CPR/BioTop/BFO framework
- Opportunity to validate against TMO dataset